

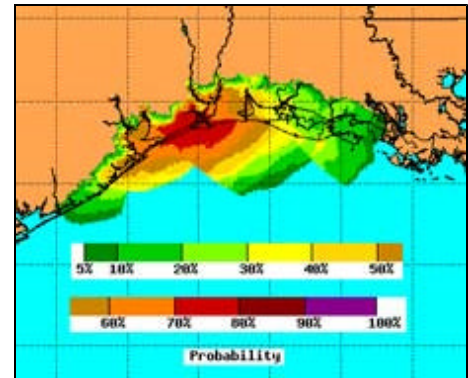


Time For a New Hurricane Rating System?

Nothing strikes fear into people along the Gulf and Atlantic coasts quite like the words "Category Five." Yet, two of the more destructive hurricanes on record -- Ike and Katrina -- were nowhere close to Category 5 status when they made landfall.

Ike was a strong Category 2 storm when its eye reached the Texas coastline during the early -morning hours of Sept. 13, with sustained winds near 110 mph, just 1 mph short of the Category 3 threshold. And Katrina was an upper-end Category 3 storm with sustained winds just over 125 mph when its center came ashore in southeast Louisiana on Aug. 29, 2005.

While the wind speeds of Ike and Katrina at landfall were nothing to sneeze at, it was the storm surge -- the wall of water pushed ashore when a hurricane's eye makes landfall -- generated by both storms that did the most damage.



An [experimental storm surge forecast](#) for Hurricane Ike, showing the percent chance that storm surge will be greater than 10 feet. Produced by the National Hurricane Center on Sept. 12.

Keep reading for more on why it might be time for a new hurricane scale. Also, see our [full forecast](#) into the coming work week. See also [NatCast](#) for the forecast for tonight's game and don't miss [SkinsCast](#) for Sunday's game.

The familiar [Saffir-Simpson Scale](#), in use since the early 1970s, rates hurricanes based solely on observed wind speed. The system is understood well by the media and public, and is often an accurate indicator of how damaging a storm will be.

But not always.

While storms with extreme winds tend to produce extreme storm surges, and storms with weaker winds tend produce weaker storm surges, sometimes the two factors are not as well correlated. For some hurricanes, the size of the storm may enhance or lessen the storm surge independent of wind strength -- the bigger the storm, the greater the storm surge, and vice-versa.

In the case of Katrina, tropical storm-force winds extended 230 miles out from its center, and storm surges ended up being as high as 25-28 feet. Ike's wind field was even more impressive, with tropical storm-force winds extending 275 miles out at one point, though its maximum storm surge of about 15 feet was [less than predicted](#).

In the April 2007 issue of the Bulletin of the American Meteorological Society, Mark Powell (NOAA) and Timothy Reinhold (Institute for Business and Home Safety) [proposed a new hurricane scale](#) based not only on the speed of a storm's strongest winds, but also how far out tropical storm-force winds extend

from the center of the storm. In science speak, the proposed scale is based on something called "Integrated Kinetic Energy," or IKE (yes, quite a coincidence with the name and all).

As Jeff Masters of Weather Underground [pointed out](#) in the lead up to Hurricane Ike, Katrina and Ike scored a 5.1 and 5.2 on this 1-to-6 scale, respectively.

The National Hurricane Center does indeed include in its public forecasts an estimate of how high a storm's surge will be. But assigning some sort of a scale, numerical or otherwise, to the predicted storm surge may help to better communicate the threat to the public at large.

I'd encourage the meteorological community and the media to slowly phase the IKE-based scale, or something similar, into operational use, and possibly eventually phase out Saffir-Simpson, which has served society well but doesn't always tell the whole story.

By Dan Stillman | September 20, 2008; 12:00 PM ET [Tropical Weather](#)

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Comments

We can go even farther than this.

I've always considered the Saffir/Simpson scale to be limited because of only five categories. The new IKE scale represents an improvement but still has the same deficiency as the Saffir/Simpson Scale.

What's really needed is an OPEN-ENDED scale, analagous to the Richter scale for earthquake rating! An open-ended cyclone rating scale can take into account more than one variable and can be better utilized for damage assessment just as is done for earthquakes.

Here are my suggested variables for such an open-ended scale:

- 1) Wind Speed.
- 2) Area covered by hurricane-force winds.
- 3) Area covered by tropical-storm force winds.
- 4) Storm surge maximum height.
- 5) Linear mileage of coastline affected by storm surge.
- 6) Precipitation intensity.
- 7) Precipitation area coverage.
- 8) Speed of forward storm motion., AND
- 9) Pressure-differential change within storm.

The open-ended system I suggest would be graded from "zero" to "infinity" by storm strength, with a rating of "ten" (10) assigned to the "historically rated perfect storm" [possibly rating Camille (1969) or Katrina (2005) as the "perfect storm" with a rating of 10.0].

This system would NOT be limited simply to tropical systems but could be used to rate ANY cyclone: tropical, subtropical, inland, coastal, Great Lakes or "nor'easter" at ANY time of the year. It would function somewhat like the Richter Scale in providing a good indicator of damage assessment for any

storm. In terms of precipitation, snow or ice could be assessed, just as with rain.

In sum, we should attempt to rate any cyclone, anywhere on the face of the earth, in terms of its total potential and kinetic energy. This was impossible in the past but can now be done, thanks to the computer.

Posted by: El Bombo | September 20, 2008 1:17 PM

The suggestion to compare the size/seriousness of a storm to something like the Richter Scale for earthquakes understates the complexity of the problem. In the first place, the Richter scale is a logarithmic scale and is requires that you have some understanding of the mathematics involved.

The listing of multiple factors

Posted by: dnwbern | September 20, 2008 1:32 PM

Yikes! I don't think many people liked Ike's IKE.

Posted by: mcleaNed | September 20, 2008 1:49 PM

As a tool for diagnosing, rather than forecasting the impact of hurricanes at landfall, "IKE" is the way to go. The problem is that to reliably predict "IKE" - a more realistic measure than wind speed alone of the impact of winds (e.g., storm surge, damage to structures) - is exceedingly more difficult than predicting a storm's intensity in terms of the CAT 1-5 of the Saffir-Simpson Scale - and there is not much, if any, skill even in that!.

Not only would we have to predict the CAT adequately, to get a handle on "IKE" we'd have to forecast the distribution of winds around the storm and their radial extent (CAT only tells one the maximum sustained winds near the surface ANYWHERE with respect to storm center). And, to reliably anticipate the the impacts of a storm even knowing "IKE" requires less uncertainty in forecasting the storm track than generally the case.

So, while the Saffir-Simpson Scale leaves much to be desired as a true measure of the potential impacts of land-falling hurricanes, invoking "IKE" might be a step too far NOW, at least for public consumption.

Posted by: Steve Tracton | September 20, 2008 2:01 PM

I completely agree that the Saffir-Simpson hurricane intensity scale needs re-examination. It understates the wind damage potential in regions like the Middle Atlantic states. There is no reference to rainfall flooding potential. And, depending on the strength, speed, track and reach of the storm, the extent of tidal flooding may not be accurately predicted. My book, Hurricanes and the Middle Atlantic States, describes many tropical cyclones that have visited the region and been more destructive than the Saffir-Simpson

Scale would have suggested.

Posted by: Rick Schwartz | September 20, 2008 3:57 PM

I agree that the IKE scale seems good. However, I think that the Saffir-Simpson scale is still better when storms are in the middle of the ocean and when landfall is not imminent. When landfall becomes inevitable, the IKE scale should be phased in to better predict overall damages (especially storm surge).

Another component that should be considered is that not all Coastal areas have the same vulnerability to storm surge. For instance, the northern texas and western Louisiana coastal areas (where Ike hit) are prime locations for storm surge as the coastline is a U shape and water can just pile and pile up. If Ike hit in a different area, the storm surge probably would not have been as severe.

Some sort of combination of the Saffir-Simpson scale and the IKE scale might be ideal. But we should remember that there are still some very severe storms that would not regester high on the IKE scale such as Andrew and Charlie because those storms were very compact. The Saffir-Simpson scale would still be better for these small and intense hurricanes.

Posted by: Anonymous | September 20, 2008 4:49 PM

My point is that "IKE" - or some other comparable single measure of a storm's damage potential - would be considerably better than a Saffir-Simpson Category. But, like the magnitude of an earthquake in terms of the Richter Scale, since it cannot be predicted, it's value is only after the fact in assessing and categorizing the possible damage. And, like earthquakes the actual direct and indirect damage of a hurricane involves much more than this single number, as, for example, the factors identified by El Bombo.

Nevertheless, I'm all for a better single number - along with the hope that advances in the basic science and computer modeling will enable reliable predictions of that number before landfall.

Posted by: Steve Tracton | September 20, 2008 5:06 PM

I like "IKE"!

(I mean the scale, not the hurricane or the president)

Posted by: Yellow Boy | September 20, 2008 5:11 PM

Steve -- You bring up some good points. I would say though that I see an IKE-type scale as potentially having considerable value in the 2-3 days leading up to landfall, not just after the fact. I'm by no means a hurricane expert, but looking back at Ike (the storm), it seemed to me that while there was a lot of uncertainty as to what Category it would be at landfall, there seemed to be at

least some confidence that the radial extent of the tropical storm-force winds would remain quite large all the way to landfall, and that consequently the storm surge would be higher than one might typically expect with a strong Category 2/weak Category 3 storm. So in cases when forecasters are somewhat confident in what the radial extent of tropical-storm force winds will be at landfall, then reporting an IKE-type rating (both an observed rating as a storm approaches, as well as what the rating is predicted to be come landfall) could have legitimate value.

Anonymous -- You also bring up a good point about how the shape/terrain of the coastline affects storm surge as well. I assume that NHC factors this into their storm surge estimates, though of course the accuracy then depends on the track forecast being correct.

Posted by: Dan, Capital Weather Gang | September 20, 2008 7:00 PM

I am not an expert at all, but I really want to advocate for a different way to rate hurricanes. I think it will save lives. I have faith in you weather guys to please see this through. Once done, past hurricanes will have to be post-rated on new scale so we public can understand.

Posted by: PennyW | September 20, 2008 9:58 PM

Switching over to, or adding in, IKE-type predictions will take a long time. People still have difficulty interpreting the main path and the cone of uncertainty. In the case of Ike, the large size (60+ miles) of the eye kept top windspeeds lower, but placed the area of maximal damage and surge 20-40 east (to Bolivar, Crystal Beach, and Gilchrist) of the "path" over Galveston.

Talk here is that while there is much damage and suffering, Ike was not the "BIG ONE" longtime Gulf coast residents have been fearing all their lives.

Posted by: JLNHInHouston | September 20, 2008 10:39 PM

I suspect that force per unit area impacted by moving wind or water increases exponentially or logarithmically as the speed of motion increases. Hence an open-ended scale analagous to the Richter scale would be appropriate.

Posted by: El Bombo | September 20, 2008 11:02 PM

Dan, I agree with you to some degree - in some cases it might be possible to estimate "IKE" based what can only be a GUESS that the strength and radial extent of winds will not change over a 2-3 day period before landfall.

However, rapid changes in winds (either strengthening or weakening) and "eyewall replacement cycles", which affect storm size, are unpredictable even over a period of less than 12 hours. So, a prediction of "IKE" beyond "persistence" (no change) is problematic at best.

Nevertheless it might be helpful after the fact to categorize storms with "IKE" to familiarize the public with the term, so that when we get a handle on the prediction challenge, the the term will be better understood and appreciated.

Posted by: Steve Tracton | September 21, 2008 10:25 AM

How about -

Triple certain death (and this time we really mean it)

Double certain death

Certain death

Probable death

Potential death

Possible severe head cold

Mr. Q.

Posted by: Mr. Q. | September 21, 2008 3:37 PM

While the Saffir-Simpson scale does not give a complete picture of a storm's potential effects, it is simple and clear to understand. A multi-factor rating system while interesting for modeling, I think would be hopeless as a forecasting tool. It's hard enough to predict the SF scale at landfall- I can imagine any multi-factor rating scale fluctuating wildly between each model run, not giving any real new information about the potential severity of the storm. Remember the NWS also issues watches and warnings to specific areas, which give some indication of the expected conditions in a given place. I would focus on improving warning information for specific areas rather than trying to assign a danger rating to the entire storm. I really like the new three-color probability charts on the National Hurricane Center's main page. They give a very easy to understand indication of tropical cyclone formation potential. Maybe there could be a tiered warning system for expected conditions. It might go something like this:

Warning Level 1- Tropical storm conditions possible

Warning Level 2- TS/Hurricane conditions likely

Warning Level 3- Severe hurricane conditions likely

Warning Level 4- Severe hurricane conditions imminent

Warning Level 5- Catastrophic hurricane conditions imminent

Expected rainfall, wind, and storm surge could be associated with each category. The warnings could be issued independently of the Saffir-Simpson ratings, and cover specific areas.

Posted by: CM | September 22, 2008 2:44 PM